

# **EPA Region 4 Multi-State Area-Wide Optimization Program**

South Carolina Department of Health and Environmental Control

## **2004 Annual Report**

April 2005

<http://www.scdhec.net/water/html/awop.html>

The South Carolina Department of Health and Environmental Control (DHEC) joined the Multi-State Pilot Program and implemented an Area-Wide Optimization Program (AWOP) in 1997. The goal of the program has been to optimize particulate removal at all surface water treatment plants.

In addition to particulate removal, the optimization focus of the Program has expanded to include Disinfection By-Product (DBP) control. The following report contains a summary of plant data for 2004, several success stories, a review of DHEC optimization activities, and conclusions based on the data. The format of the report follows the AWOP model; status, evaluation, follow-up, and maintenance components.

### **Microbial Status Component**

The 2004 turbidity data for all South Carolina surface water treatment plants (61 plants) have been updated. Several plants have shown improvement since the 2003 annual report.

As demonstrated with the past annual reports, South Carolina continues to show microbial optimization success at our surface water treatment plants. An initial priority list was compiled of the ten worst performing plants in 1997. Optimization efforts were then focused on these ten plants. Through our optimization efforts and enforcement actions, several of those plants have shut down. An updated list has been compiled for 2004. The table below shows the new list and performance numbers from 2003 and 2004.

**Surface Water Treatment Plant Rankings in 2004**

<b>2004 Rank</b>	<b>Raw Average</b>		<b>Settled 95<sup>th</sup></b>		<b>Filtered 95<sup>th</sup></b>	
	<b>2003</b>	<b>2004</b>	<b>2003</b>	<b>2004</b>	<b>2003</b>	<b>2004</b>
1	36.8	31.2	8.7	8.3	0.10	0.09
2	5.4	5.9	1.5	1.4	0.49	0.46
3	5.8	4.5	1.7	2.1	0.18	0.23
4	26.0	13.2	2.4	1.5	0.22	0.21
5	40.9	42.0	6.3	4.4	0.40	0.16
6	9.9	5.6	0.5	0.2	0.20	0.19
7	11.7	7.2	2.1	1.4	0.16	0.21
8	12.4	17.5	2.9	9.3	0.15	0.20
9	12.0	15.1	4.9	4.7	0.18	0.13
10	17.2	14.5	2.6	3.3	0.09	0.19

Notes: Plant rankings are out of 61 plants. 1 is worst, 61 is best.

The optimization program is discussed during the annual sanitary survey at each surface water treatment plant. Charts and data are presented and discussed for the time period since the last survey of that water system. In some cases, this annual discussion alone has resulted in plant improvements.

Each year there have been several plants that have improved their performance. These success stories are used to demonstrate success of the optimization program. There are many plants that could be discussed, but only the more significant improvements are presented here.

#### City of Rock Hill

The City of Rock Hill's water treatment plant is the first facility that has met the AWOP goals after going through both a Comprehensive Performance Evaluation and Performance Based Training. The City has worked extremely hard for the last several years in order to meet the goals. There has been a large turnover in staff that has, at some times, left the remaining employees working long hours for many days. Despite these hardships, the City remained committed to meeting the goals and worked tenaciously to achieve them.

Between 2003 and 2004, the City significantly improved their performance. The plant has a regulated capacity of 20 MGD and serves approximately 76,000 people. In 2003, there were 134 days when the settled water turbidity was over 1 NTU and 34 days when the filtered water turbidity was over 0.1 NTU. In 2004, there were 14 days when the settled water turbidity was greater than 1 NTU and 5 days when the filtered water turbidity was greater than 0.1 NTU. The plant has improved their performance by 65% between 2000 and 2004. The following chart shows their performance over the last 5 years for settled and filtered water turbidities.

City of Rock Hill		
Year	Settled 95 <sup>th</sup> (NTU)	Filtered 95 <sup>th</sup> (NTU)
2000	3.09	0.17
2001	1.58	0.13
2002	1.92	0.10
2003	4.67	0.12
2004	1.39	0.06

#### City of Cayce

The City of Cayce's WTP was gracious enough to host a training event for the Region last June during our quarterly meeting in Columbia. At that time, several of the operators indicated that their goal was to meet AWOP goals and were disappointed in themselves that they hadn't met the performance goals at that time. The plant staff worked hard and applied many of the recommendations that were given during the training event and met the goals in 2004.

The City of Cayce plant has a regulated capacity of 9.6 MGD and serves approximately 15,250 people. In 2003, there were 34 days when the settled water turbidity was over 1

NTU and 25 days when the filtered water turbidity was over 0.1 NTU. In 2004, there were 6 days when the settled water was greater than 1 NTU and 6 days when the filtered water turbidity was greater than 0.10 NTU. In 2000 the City of Cayce experienced a source water contamination event. As a result, the plant had to change their raw water source as well as reconfigure the existing treatment plant. The City of Cayce upgraded from a “package-type” treatment facility with little pretreatment to a facility with upfront treatment and circular clarifiers.

#### **City of Cayce**

<b>Year</b>	<b>Settled 95<sup>th</sup> (NTU)</b>	<b>Filtered 95<sup>th</sup> (NTU)</b>
1997	8.34	0.26
1998	7.79	0.29
1999	2.10	0.23
2000	Offline	
2001	Offline	
2002	1.07	0.18
2003	1.68	0.11
2004	1.28	0.09

#### City of Orangeburg

The City of Orangeburg's WTP has shown significant performance improvement between 2000 and 2004. The plant has a regulated capacity of 19 MGD and serves approximately 61,000 people. In 2003, there were zero (0) days when the settled water was greater than 1 NTU and 48 days when the filtered turbidity was greater than 0.1 NTU. In 2004, there were zero (0) days when settled turbidity was greater than 1 NTU and 11 days when the filtered turbidity was greater than 0.1 NTU. The following table illustrates the plant performance.

#### **City of Orangeburg**

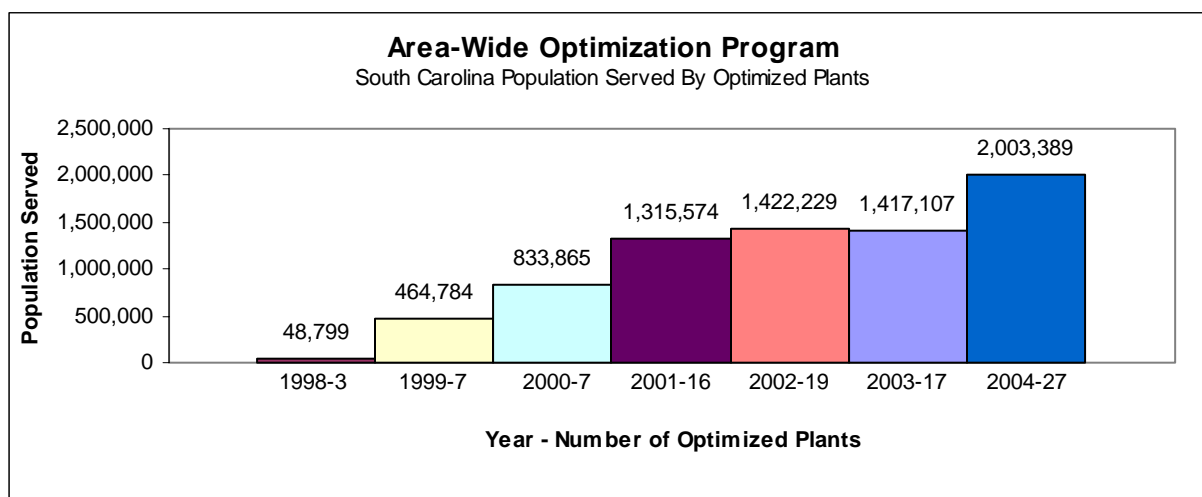
<b>Year</b>	<b>Settled 95<sup>th</sup> (NTU)</b>	<b>Filtered 95<sup>th</sup> (NTU)</b>
2000	0.70	0.19
2001	0.55	0.19
2002	0.83	0.16
2003	0.70	0.13
2004	0.77	0.09

## **Microbial Summary**

Each year, an increasing number of systems have achieved optimized performance. In 2004, 27 plants met both goals. This has increased from only seven plants meeting the goals in 2000. The table below shows how many plants met the goals each year.

<b>Plants Meeting Performance Goals</b>	
<b>Year</b>	<b># Plants</b>
2000	7
2001	16
2002	19
2003	17
2004	27

EPA headquarters has become increasingly interested in the amount of population served by optimized surface water plants. SC has been tracking this performance for seven years.



The above chart shows the population served by optimized plants by year. The population served by optimized plants (met settled & filtered goal) was 48,000 in 1998 and over 2 million in 2004. In 2004, a total of approximately 2,819,926 people statewide were supplied by surface water. Of this, approximately 71% are supplied water from optimized plants.

**Settled Water Goal** – Of the 61 surface water systems in South Carolina, 42 met the settled water turbidity goal.

**Filtered Water Goal** – Of the 61 surface water systems in South Carolina, 34 met the filtered water turbidity goal.

### **Disinfection By-Product Status Component**

The Disinfection By-Products (DBP) status component includes data from all of the water systems that use surface water as their source (excluding purchased systems). A scoring and ranking system has been developed for the DBP status component. The DBP goals used to determine optimization in South Carolina are similar to the goals developed by the EPA Technical Support Center. Disinfection by-product data is collected by DHEC, so there are several years of data. To determine optimization with respect to the DBP goals, locational running annual averages (LRAA's) are calculated quarterly. The maximum LRAA is taken from each location for a 1-year period and all of the maximums are averaged. The average of these maximums must be less than 60 ug/l for THM's and less than 40 ug/l for HAA's. A summary table is shown below.

**Example DBP Optimization Determination Worksheet**

System Name	Sample Site	2003				2004			
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
	1	27	69	101	44	24	59	120	35
	2	30	75	95	53	35	90	128	55
	3	29	52	78	41	21	50	98	37
	4	25	79	105	53	21	36	90	26
	LRAA 1				60	60	57	62	60
	LRAA 2				63	65	68	77	77
	LRAA 3				50	48	48	53	52
	LRAA 4				66	65	54	50	43
	MAX LRAA				66	65	68	77	77
	Avg of Max LRAA's								71
	DBP Goal								60

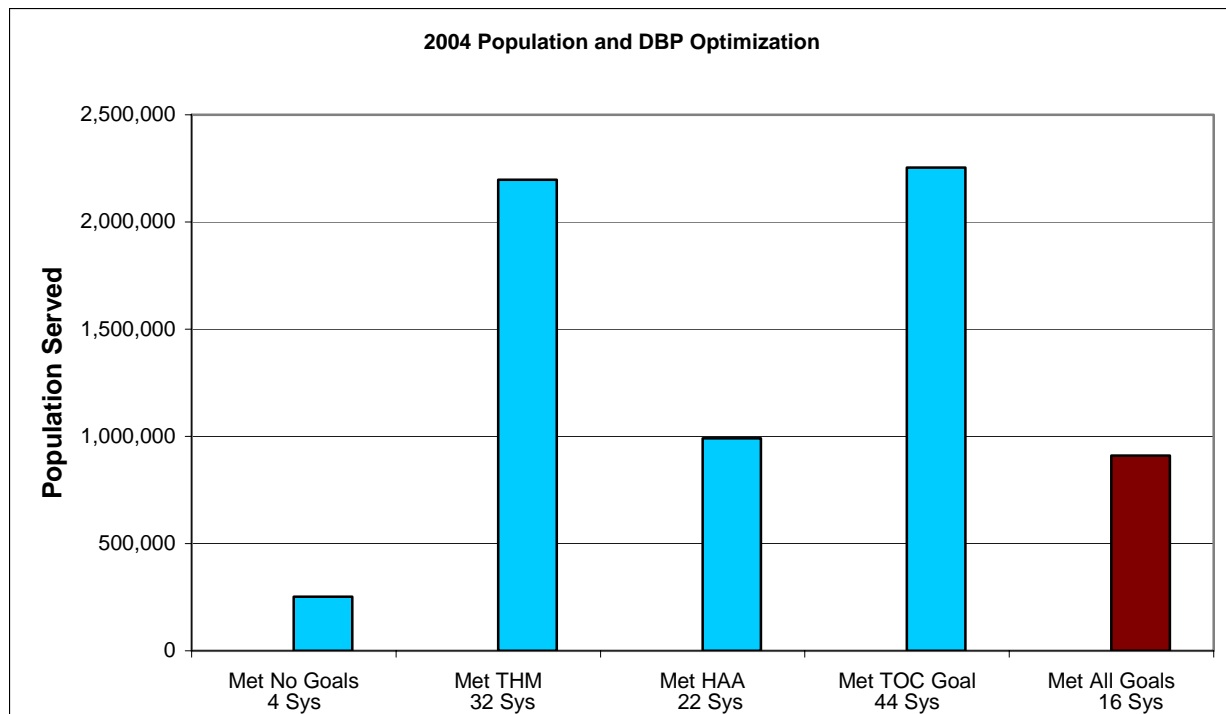
A priority-ranking list was developed for the DBP status component where points are given for different parameters. Systems get the most points coming from the operational performance data. Similar to the microbial priority ranking, the higher DBP scores reflect poorer performance than the lower scores. The following list shows the ten highest scoring systems.

**DBP Priority Ranking for 2004**

Rank	THM Perf. Goal = 60	HAA Perf. Goal = 40	TOC Perf. Goal = 1.1	Population
1	90	83	1.4	14,000
2	83	70	1.0	1,500
3	93	93	1.2	6,000
4	57	62	1.0	16,000
5	66	52	0.9	3,000
6	69	51	1.3	5,000
7	98	22	1.1	4,500
8	61	52	1.2	25,500
9	65	44	1.1	11,500
10	71	50	1.1	17,000

One of the statistics that was used to analyze the DBP performance was the percent difference from the goal. If a system did not meet the THM or HAA goal, how far from the goal was their performance? The following chart summarizes these statistics.

	Avg THM % Diff	# Above Goal	Avg HAA % Diff	# Above Goal
Ten poor performers	29%	9/10	37%	9/10
Systems less than 10,000 Pop.	28%	8/15	42%	8/15
Systems above 10,000 Pop.	15%	13/39	23%	23/39
Ten best performers	0%	0	18%	3/10



The above chart shows the breakdown of DBP optimization for 2004. Most systems do not have trouble meeting the TOC or THM goals. As shown by the chart, and the above table, South Carolina systems have a more difficult time optimizing for HAA's. Of the ten poor performers, 5 are upgrading treatment to control DBP's, and one has shut down their surface plant and is buying groundwater. There were also 4 systems that did not meet any of the 3 goals. There were approximately 2.8 million people served by surface water systems and almost 1 million or about 32% served by plants optimized for DBP's.

### **Evaluation Component**

There are several tools used in the evaluation component of the AWOP Model. Sanitary surveys are an excellent tool for discussing a plant's optimization performance. The CPE is another important evaluation component tool. After the status component is completed each year, staff members can determine which plant or plants would be benefited by a CPE.

### **Follow-up Component**

In South Carolina, the major tool used in the follow-up component is performance-based training, or PBT. The training is comprised of several centralized training events with hands on activities followed by facilitation activities. The focus of the training is to transfer optimization skills to plant operators and encourage them to use what they learn to optimize their plants. PBT is implemented with multiple utilities simultaneously in order to foster both partnering and competition between the utilities.

Currently, DHEC is working on finishing a second round of PBT. Chester Metro, Camden, and Rock Hill have all been through four of the five sessions. Each of the participating water systems has continued to show successes. Special studies have been discussed and implemented at the plants.

### **Maintenance Component**

The maintenance component incorporates AWOP activities into other job activities. Some examples of this are design review, staff training, funding, etc. Optimization standards are applied to proposed new facilities during the permit review process. In addition, when a water plant wants to use high-rate filtration (greater than 4.0 gpm/ft<sup>2</sup>) they must complete a 12-month study. When the study is completed, data is reviewed with respect to the optimization goals and sometimes high-rate filtration is not approved based on not meeting the optimization goals.

### **2004 AWOP Activities**

1. CPE's attended: Opelika, AL (DBP-CPE),  
Thomson, GA (DBP-CPE),  
Chatham Co, NC
2. Performance Based Training:  
Round 3 – Chester Metro, Camden, Rock Hill  
Round 4 – Chester Metro, Camden, Rock Hill
3. Quarterly meetings attended: Columbia, Frankfort.
4. AWOP Presentations given:  
DHEC Annual SWTP meeting  
(Attended by R4 EPA, DHEC Commissioner, Deputy Commissioner)  
DHEC Board Meeting  
DHEC Monthly Informational Exchange mtg.  
AWWA / WEA Optimization Workshop, Charleston



5. Publications: Articles written about AWOP in DHEC publication Newsleak, AWOP included in EPA mid-year and end of year reports, DHEC AWOP website continually updated.
6. Other activities: Filter assessment technical assistance; Jar testing technical assistance, Discussion of AWOP during plant sanitary surveys

### **Conclusions**

Data analysis for 2004 has shown the largest number of plants meeting the microbial goals since the program inception. This large increase, coupled with roughly a third of systems meeting the DBP goals is encouraging. Upper management considers the program a success and routinely mentions AWOP at agency-wide meetings and workshops. In addition, we have received numerous technical assistance and information requests from states in other EPA regions. Optimization has also been discussed as a security measure to lessen the impacts from a terrorist event. South Carolina DHEC drinking water staff remain very active in the program and continually work towards our goal of having all systems optimized for microbial and disinfection by-products.